3.4 Clearcutting in the Forest

In the satellite image on the next page, we use those bands of the electromagnetic spectrum which best show the forest types in this area, as well as the clearcutting that has taken place and the forest re-growth that is occurring. "Clearcutting" means that all of the trees in an area are cut, not just selected trees. The standing forest of coniferous trees is shown as dark green, the bare ground (areas that have been recently cut) shows as pink, and the newly growing trees (and grasses and bushes) are yellow in colour. Notice also, that the logging roads (used by the logging trucks) are pink; where they cross the clearcut areas, they are a darker pink. A number of river valleys criss-cross this area, and of course, extend into some of the clearcuts.

Step A:
Find in the satellite image: standing forest, clearcut areas, logging roads, forest re-growth areas, river valleys.

On another page, you will find a map. The red lines show some of the roads that you can also see on the satellite image. The black outlines on the map indicate where the logging company was allowed to cut the trees last year.

Step B:
Trace the lines on the map onto a sheet of acetate. Use a different colour for roads and for the "allowable cut" area outlines.

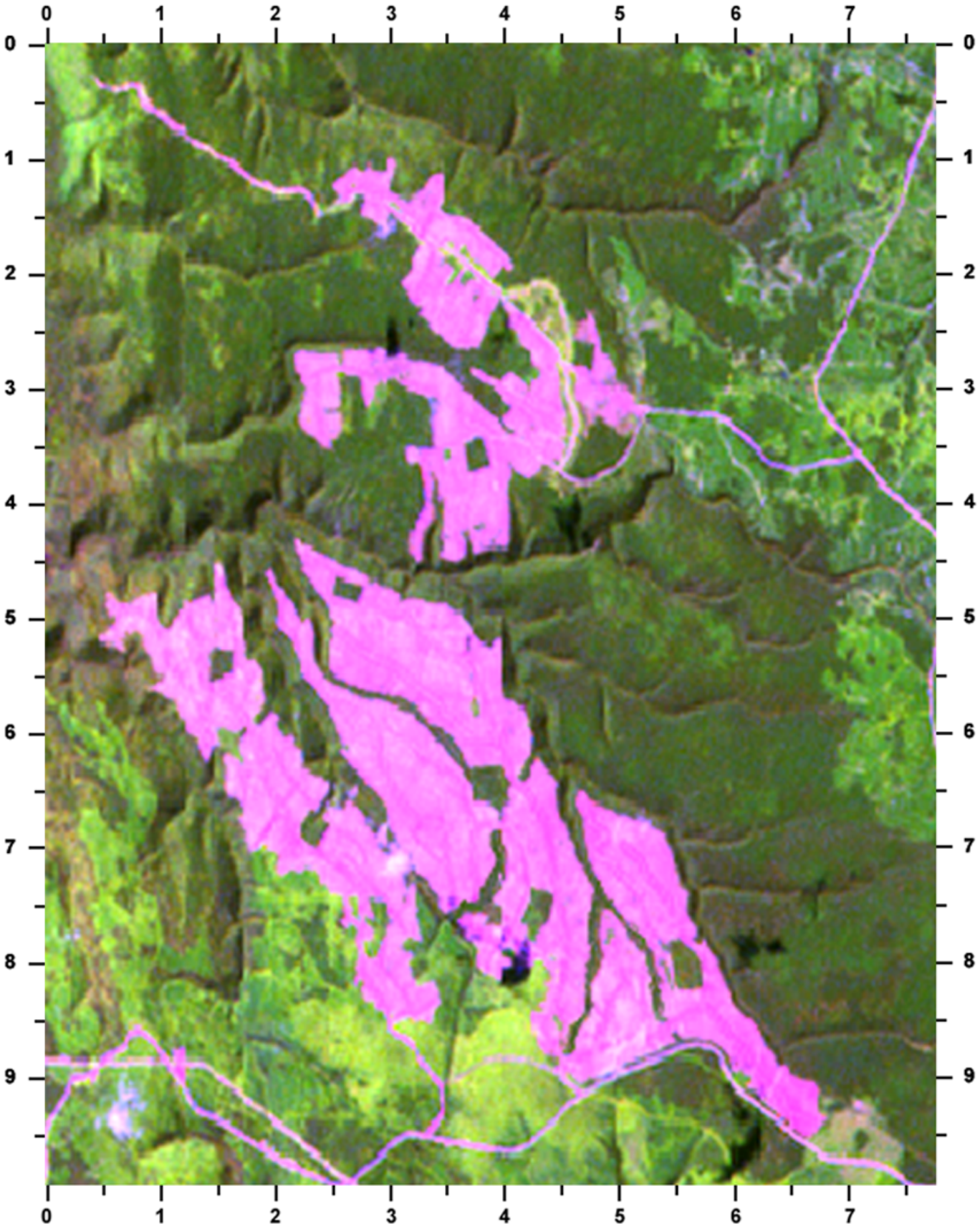
Step C:
Place the acetate (with the lines you've traced) onto the satellite image. Fit the two together by matching the road lines from the acetate, to the roads as seen on the satellite image. Remember that while the satellite image shows all of the existing roads, only some of them are on the map. Only match the roads; don't try to match the clearcut areas.

Step D:
Once the roads are matched between the acetate and the satellite image, check how the "allowable cut" areas on the acetate match the actual clearcuts on the satellite image. Can you find some areas where the company was allowed to cut but didn't? Can you find some areas where the company wasn't allowed to cut but did? Identify them (non-permitted cuts only) by giving the coordinates of the middle of each such area, using the number grid on the edges of the image.

Answer: (___, ___) (___, ___) (___, ___)

Step E:
How many square kilometres were cut outside the "allowable cut" areas? Use the dot grid technique in Appendix A to measure those areas. Each five dots that you count, will represent 1 square kilometre.

Answer: _____ sq. km.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Map of "Allowable Cuts"

Black Lines: outlines of areas that may be cut

Red Lines: roads

3.5 Oil Spill Danger

Image - June 10:

What do we see on the satellite image of June 10? About 20 km offshore, we see a ship travelling parallel to the coastline, and it looks like it has released some oily material. The lighter blue tone located behind the ship is an oil slick floating on the water surface. If the water current pushes that slick towards the coast, then the shoreline will be polluted with oil! If we act quickly, we can send people and equipment to try to protect the shore with floating barriers. But where do we send them? Should we send the team to Dewel, Canto, or Ormond? These towns show up as pink areas on the coast, because the image is processed to show vegetation as green and yellow, and non-vegetated areas like pavement and bare earth as pink. These are not the real colours that we would normally see by eye.

Question A: If you know that the water current is coming from the north-west, you should be able to estimate which part of the coast the oil slick will reach. The nearest town is where we should send our clean-up team. Considering only what we knew on June 10th, which town should it be?

Answer:_____

Image - June 12:

We managed to get another satellite image of this area, two days later. The image of June 12 shows the slick (the ship itself is long gone) as it spread and moved towards the coast. But it didn't move exactly in the direction that we expected. Wind, waves, currents and tide combined in a complicated way can make it difficult to predict the slick motion. But with this second image, we can tell how the slick actually moved.

Question B: Trace the outline of the slick on the June 12 image onto a sheet of acetate. Also trace the coastline onto the same acetate. Position this acetate carefully on top of the June 10 image by matching the coastline on the acetate with the coastline on the image. Draw a straight line on the acetate joining the approximate middles of the two oilslick positions. Extend this straight line until it hits the coastline. If the oilslick keeps moving the way it has in the last two days, then it should hit the coastline near the town of:

Answer: _____

Question C:
How long will it be before the slick reaches the coast? No more hints or instructions for this! You figure it out! The slick will arrive on:

June_____

Question D: We also need to know how many floating barriers to send to this location. It will depend on how much oil there is in the slick. Measure the area of the slick on the July 12 image using the dot grid technique in Appendix A. Each five dots that you count, represents 1 square kilometre. We will need to send 4 barriers for each square kilometre of slick that we measure. How many do we send?

Answer: _____


June 10
Ormond
Canto
Dewel
N
10 km
Canada Centre for Remote Sensing


June 12
Ormond
Canto
Dewel
N
10 km
Canada Centre for Remote Sensing

3.6 Crop Types

Introduction

This satellite image shows a farming area with many fields and several types of crops growing in mid-summer. The different colours indicate different crops, or perhaps what condition the crop is in. Small white dots in some fields are the clearings where the farmhouses and barns are located. Sometimes the image captures a crop being harvested. Look for instance at the field at (3.7, 6.7). The different coloured "outline" of the field indicates that the farmer has just started to harvest the corn, starting, of course, on the outside of the field. The very dark green, irregular shaped areas are small patches of woods (trees) – see, for example: (2.8, 3.8).

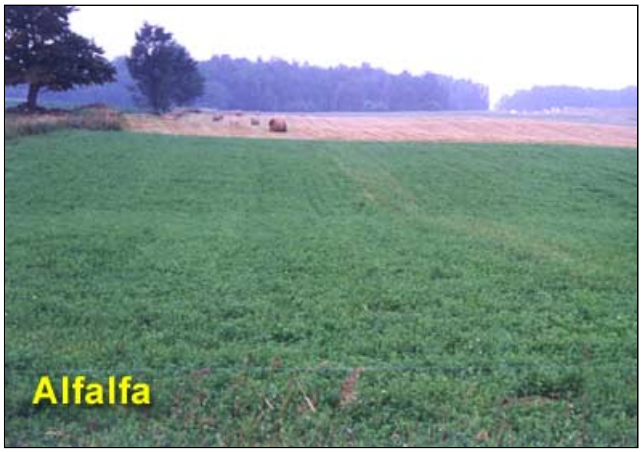
Task #1:

There is a larger town and a smaller village in this satellite image. The approximate middle of each are at the coordinates:

town: (____, ____) village: (____, ____)

A river cuts through the image. It is so narrow that you can't see the water itself, just the vegetation on the river bank. It doesn't follow the road grid and is not a perfectly straight line. It exits the picture on the right at (6.0, ____).

A railroad also cuts through the image. It's a much straighter line and comes from the town and exits the image on the left at (0.0, ____).



Task #2

What type of crop is growing at:

a) (1.5, 4.6) _____

b) (2.9, 3.3) _____

c) (5.1, 1.7) _____

d) (4.4, 1.2) _____

e) (1.4, 3.1) _____

f) (3.8, 2.2) _____

g) (4.7, 3.0) _____

Task #3:

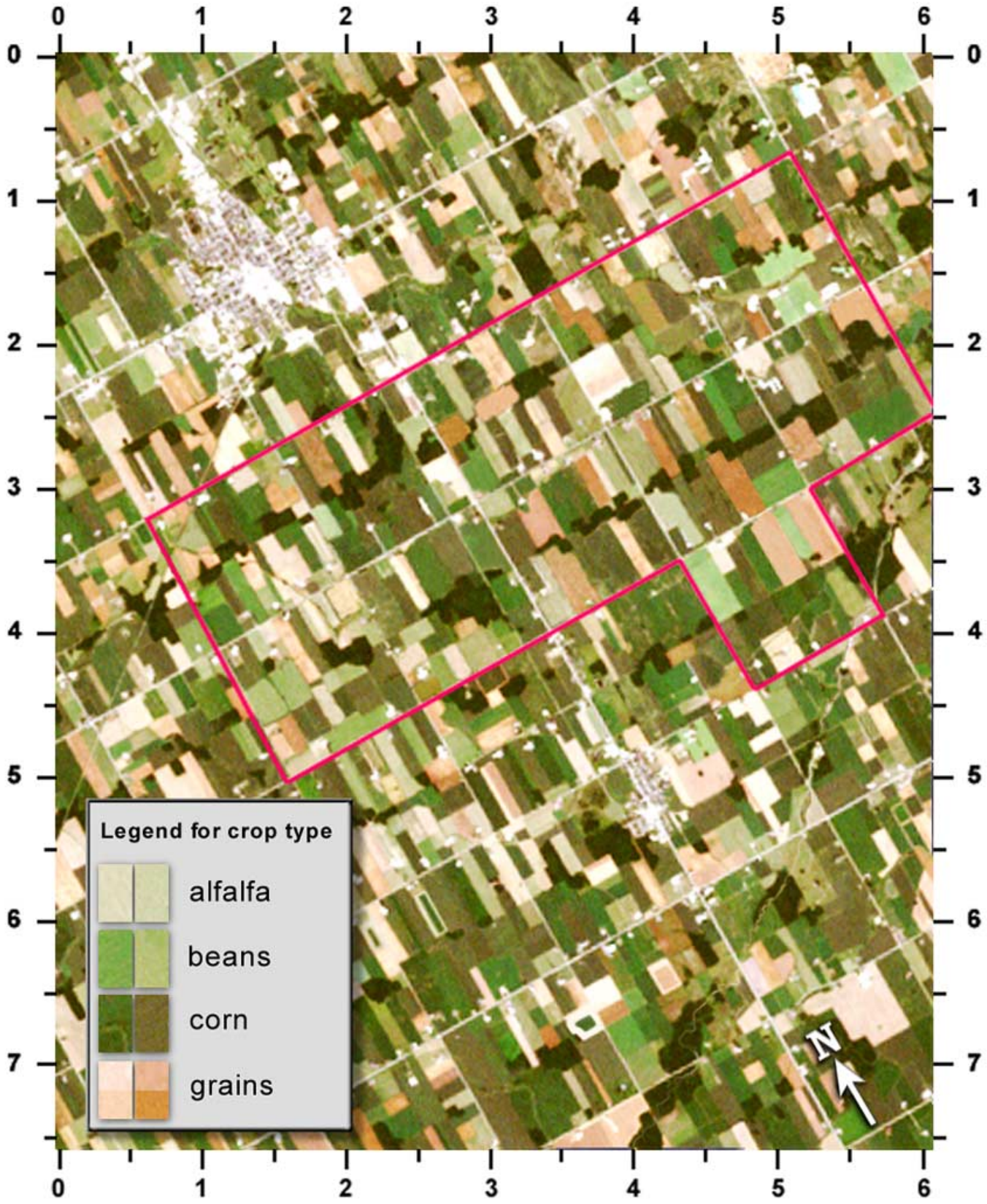
The second satellite image is the same area, but it was imaged during a time when too much rain has caused a small river to flood. The water rose about ½ metre above normal, which was enough to flood many farms.

a) What are those patches of green inside the flood zone?

_____

b) An insurance company has insured the grain crops for those farms inside the red outline. For how many fields will they have to pay compensation?

_____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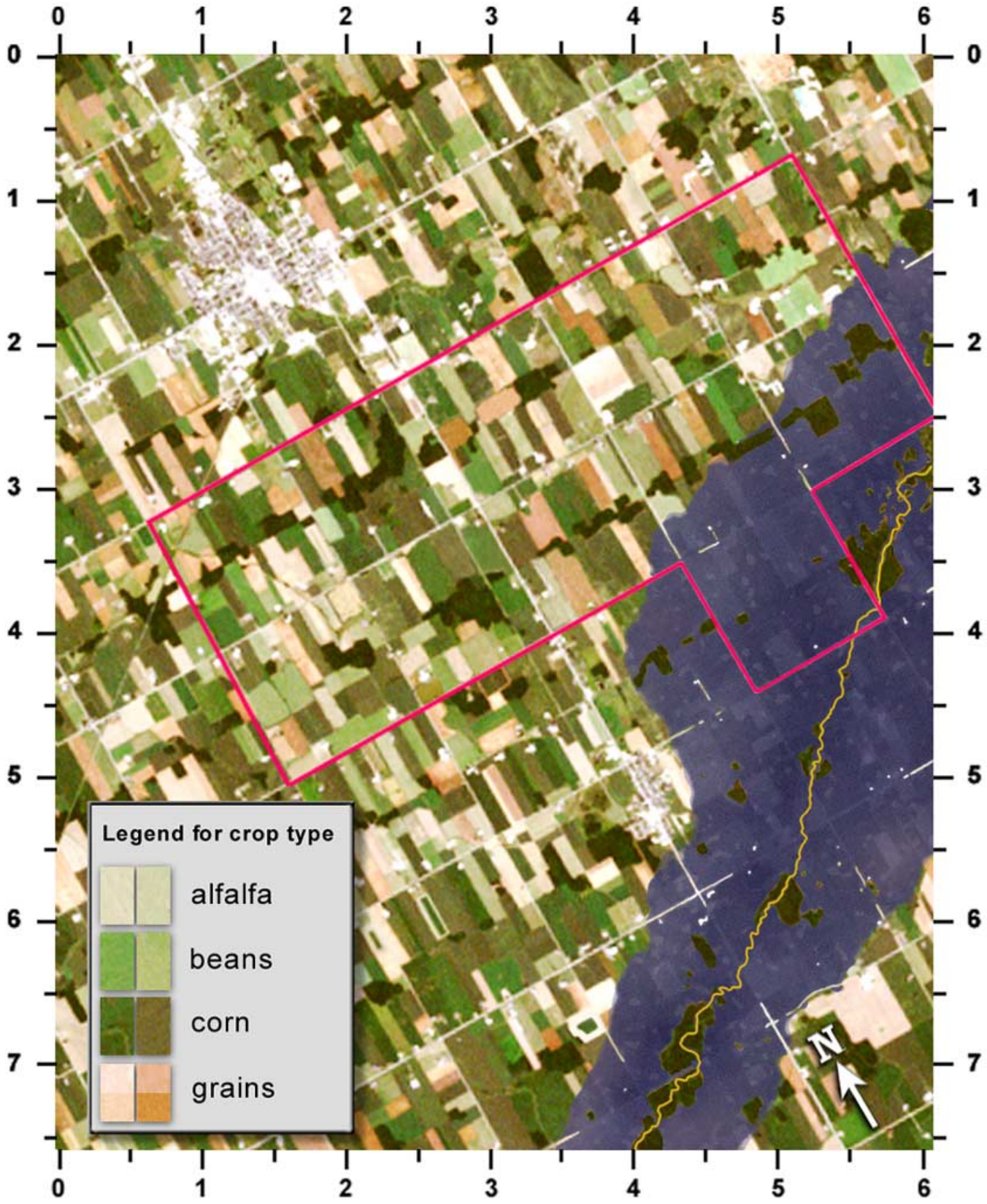
6
Legend for crop type
alfalfa
beans
corn
grains
N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6
Legend for crop type
alfalfa
beans
corn
grains
N

3.7 Forest Fire

Introduction:

There are many forest fires in Canada every year. The ones in the northern parts of Canada are difficult and expensive to fight, because it's complicated to get people and supplies quickly to those isolated areas, and there are probably no airports or roads. Satellite images can be used to map the types of vegetation, sources of water and areas that are difficult to travel over, like swamps.

In this satellite image, the yellow and green colours show unburned forest and other vegetation types. The red/orange colour is a recently burnt area. The black shapes are lakes and rivers. The small pink areas around the burn are unvegetated areas where rock shows through the soil. Notice that the fire was stopped mostly by reaching the edge of a river or lake. At other points, it probably stopped because of swamps or bare ground or because the wind reversed direction.

The main camp for firefighting in this area is at location "A". A smaller advance camp has been set up at "B", because there is a good chance that the fire will flare up again and the wind will push it to the north. We need to send people, equipment and supplies by boat to the advance camp from the main camp.

Task #1:

Find the shortest route by water from "A" to "B". Measure this distance, using string (or a shoelace).

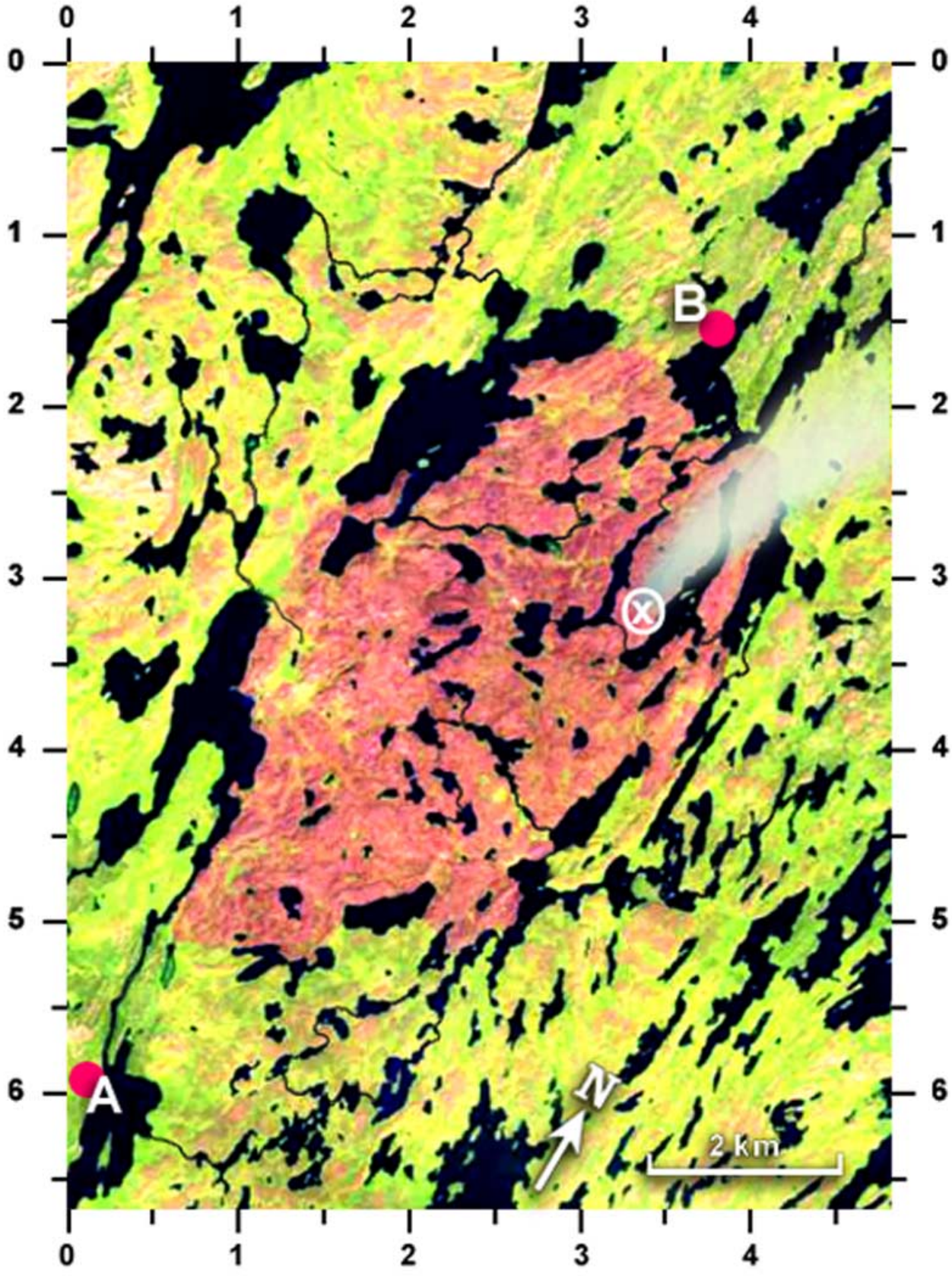
That distance is: _____ km.

Task #2

A fire has flared up at "X". We can use firebombers (airplanes that drop water) to try to douse it. The planes need 2km of straight-line distance over water to safely collect a full tank of water. To which lake would you send them?

The middle of the lake that is closest for such a purpose is at: (____, ____).

The middle of the next closest lake would be at: (____, ____).


0
1
2
3
4
5
6
B
X
A
N
2 km

3.8 Navigating a Ship Through Ice

Introduction

In Canada's ice-infested waters, ship captains have to pay careful attention to where, how much and what type of ice is in front of them. Going the wrong way can waste fuel, slow the ship down and be dangerous if the ship gets damaged or gets stuck in the ice. Satellite images can give a large view of the area in front of a ship and will allow an experienced interpreter to estimate the age, type and concentration of the ice. With radar sensors, images can be acquired through clouds and even at night! The images are sent to the ship by communications satellites, so the captain can see the most recent ice conditions in front of his ship.

The image in this activity shows a radar image of ocean ice, from Canada's RADARSAT satellite. An example of a first year ice floe is shown at "A". Broken ice fragments, called "brash ice", such as at "B", fill much of the space between the floes. A crack in the ice, exposing the open water surface is called a "lead" and one example is shown at "C".

A ship captain would want to navigate through leads as much as possible, since there is no ice resistance to his ship's travel. He would also want to avoid ice floes, since the brash ice is easier for the ship to push through.

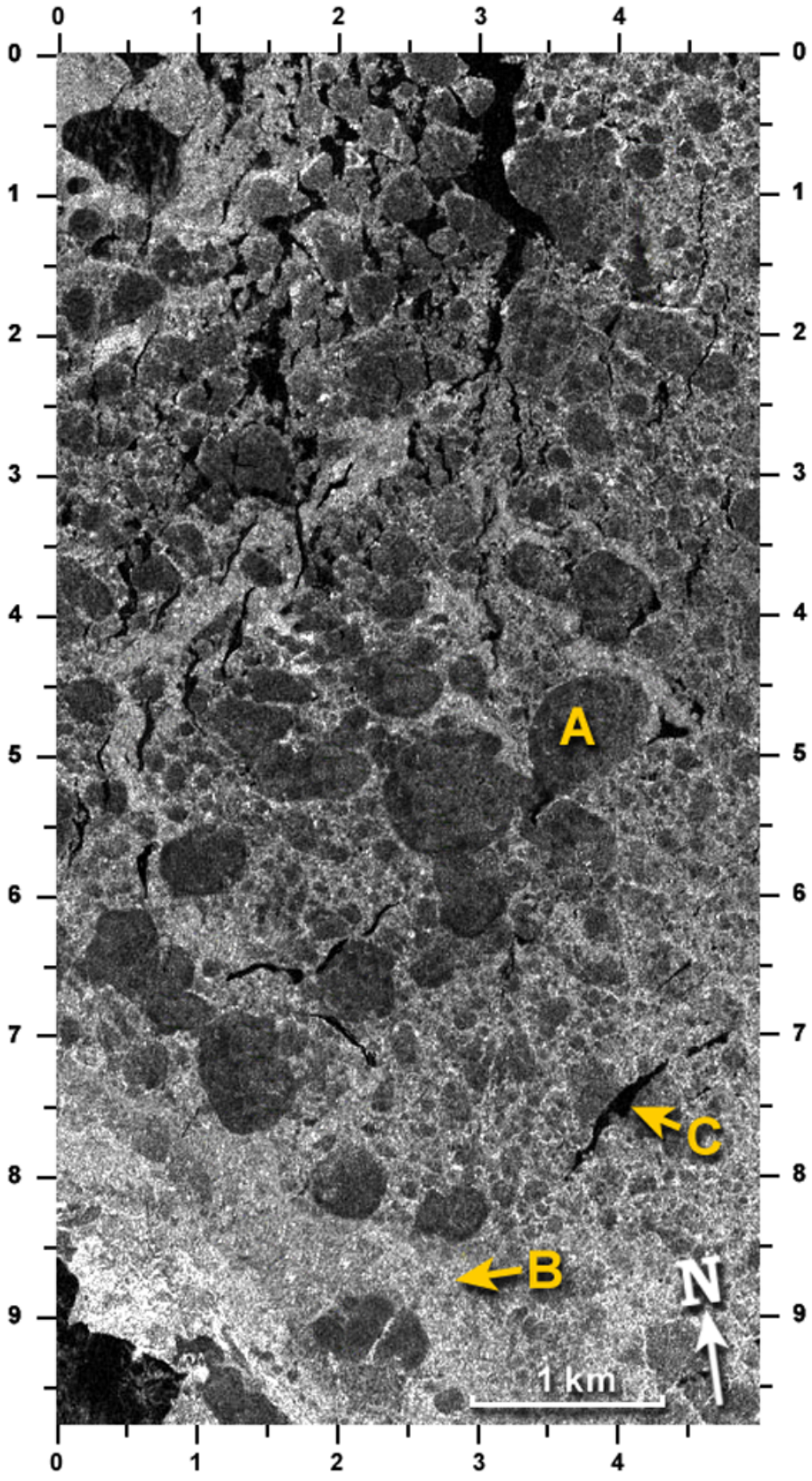
Task

Starting at (3.0, 0.0) and ending up at (0.5, 9.5), find the best passage for a ship. Use leads, wherever possible, and avoid ice floes. Measure the distance over the route that you've chosen.

That distance is:

_____km.

Hint: It should be less than 10 km.



Radar Image Legend

A. Ice Floe (solid ice)

B. Brash Ice (ice fragments)

C. Lead (open water)

3.9 You Figure it Out !

Read this first:

Here are two small sections of a satellite image of the Queen Charlotte Islands, off the coast of British Columbia. We used some visible light and some infrared light information in these images, to better show vegetation. Healthy and dense vegetation is red. As the vegetation gets less dense, it is shown as pink (less red). When there is no vegetation at all, like bare earth, rock or pavement, it shows up as light blue. The deep water is very dark, almost black.

The top image shows a very small town called “Sandspit”, at the edge of a forest and on the shore of the Pacific Ocean. The bottom image is of another town called “Queen Charlotte City”, also on the shoreline and at the edge of the forest.

Now choose the correct answer to these questions:

Sandspit: at A

There are some small openings in the forest which are caused by:

1. Insects destroying the forest
2. Beavers cutting down the trees
3. People cutting some of the forest to make room for houses and gardens
4. Aliens landing their flying saucers.

Sandspit: at B

There is a light blue, straight line which is:

1. A scratch on the picture
2. A long, skinny garden
3. A short road
4. An airplane landing strip

Sandspit: at C

The colouring here is pink and white which means that:

1. The vegetation is very sparse (thin).
2. There is dense forest here.
3. There are lots of pink and white buildings.
4. Aliens are still landing their flying saucers.

Sandspit: at D

This patch of dark, slightly red coloured area is off the shoreline, in the ocean. If red colour means vegetation, then this area must be:

1. Trees that have been cut and are now floating in the ocean.
2. Seaweed growing in shallow water.
3. A flooded lawn
4. Aliens growing an underwater garden.

Sandspit: at E

This light blue feature in the ocean can't be vegetation but it's a strange shape. It must be:

1. Made of sand
2. Naturally, not artificially created
3. A shallow-water sandbar formed by tides and current
4. All of the above

Sandspit: at F

There is a light blue semicircle on the shoreline. The colour and shape mean that it is:

1. A sand pit
2. A hill made of sand
3. Deep water
4. Sand outflow at the mouth of a river.

Queen Charlotte City: at A,B

Two different shades of red in a forested area mean that:

1. The imaging sensor on board the satellite is confused.
2. There are two major types of forest here.
3. One shade of red is forest, the other is sand.
4. The darker shade of red is a cloud shadow.

Queen Charlotte City: at D

There is a light blue fringe around each island in this image because:

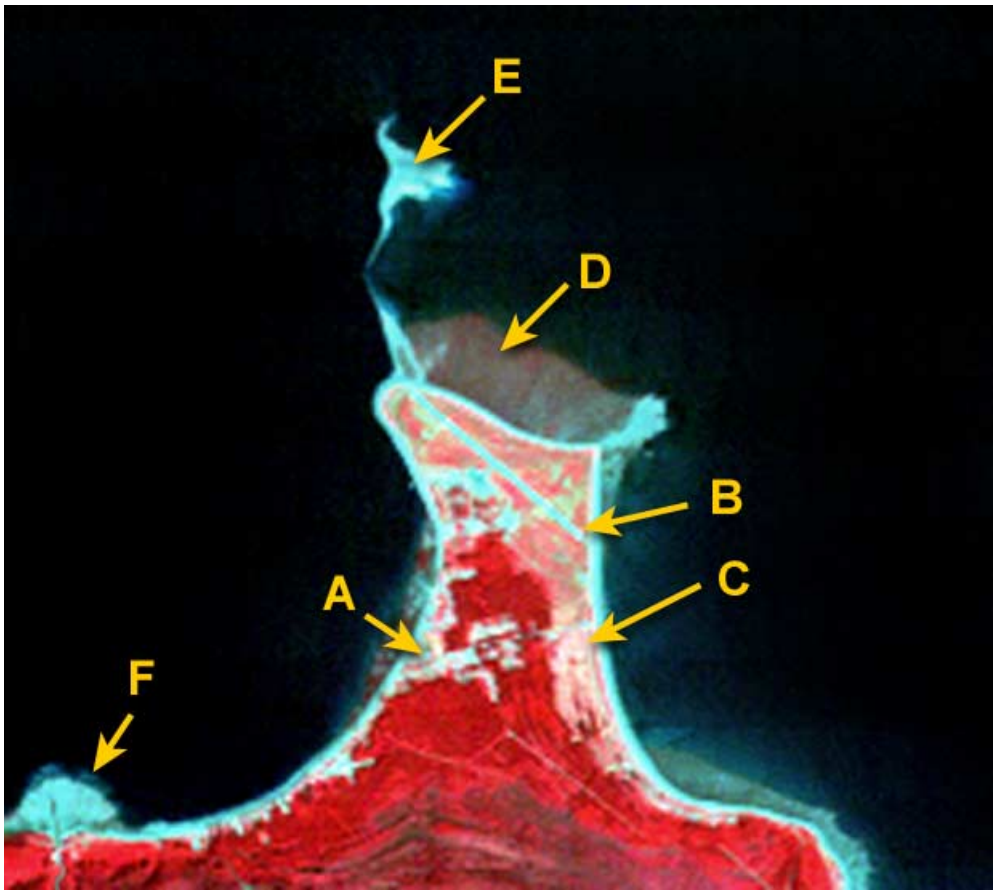
1. There is no forest there (red colour).
2. The water is not deep (black colour).
3. All the shorelines are made of sand and rock in shallow water.
4. All of the above.

Queen Charlotte City: at C

This area of light blue covers Queen Charlotte City. It extends along the shore and has patches inland. You can see roads through the forest and a pier for docking ships. But you cannot see streets or buildings on this image because:

1. The buildings are hidden in the woods.
2. There are no buildings here, just tents.
3. There are very few buildings and they are too small to see with this imaging sensor.
4. The buildings look the same as trees.

Sandspit



Queen Charlotte city